## Claims

[c1] 1.A color converter and enhancer comprising:
an input stream of incomplete pixels each having a red (R), a green (G), or a blue (B) value, but each incomplete pixel not having all three R, G, B values;
a first multi-line buffer, receiving a first number of multiple lines of the incomplete pixels, the first number being less than a number of lines in a frame;
a luminance generator, receiving R, G, and B values from the first multi-line buffer, for generating preliminary luminance values;
a second multi-line buffer, receiving a second number of multiple lines of the preliminary luminance values, the second number being less than a number of lines in a frame and the second number being not larger than the first number;
an enhancer, receiving the preliminary luminance values from the second multi-line buffer, for adjusting the preliminary luminance values to generate enhanced luminance values;
a third multi-line buffer, receiving a third number of multiple lines of the enhanced luminance values, the third number being less than a number of lines in a frame and the third number being not larger than the second number; and
a chrominance generator, receiving the enhanced luminance values from the third multi-line buffer and receiving some of the incomplete pixels from the first multi-line buffer, for generating chrominance values using the enhanced luminance values and some of the incomplete pixels,
whereby enhanced luminance values are generated and used for chrominance calculation.

[c2] 2.The color converter and enhancer of claim 1 wherein the enhancer sharpens edges by applying an edge-sharpening filter to the preliminary luminance values to generate the enhanced luminance values.

[c3] 3.The color converter and enhancer of claim 2 wherein the edge-sharpening filter receives preliminary luminance values in at least 3 lines for each line of enhanced luminance values generated.

[c4] 4.The color converter and enhancer of claim 3 wherein the edge-sharpening

filter receives a box of 3 by 3 preliminary luminance values to generate a center enhanced luminance value in a center of the 3 by 3 box.

[c5] 5.The color converter and enhancer of claim 4 wherein the edge-sharpening filter includes a 3 by 3 set of coefficients including a center coefficient that is multiplied by a center preliminary luminance value and surrounding coefficients that are each multiplied by surrounding preliminary luminance values;
wherein the center coefficient has a magnitude that is larger than magnitudes of each of the surrounding coefficients.

[c6] 6.The color converter and enhancer of claim 5 wherein the center coefficient has a magnitude that is at least as large as a sum of the magnitudes of the surrounding coefficients.

[c7] 7.The color converter and enhancer of claim 6 wherein the center coefficient has a sign that is opposite to signs of the surrounding coefficients.

[c8] 8.The color converter and enhancer of claim 2 wherein the luminance generator receives R, G, and B values from at least 3 lines of the first multi-line buffer; the luminance generator generating preliminary luminance values for a center line in the at least 3 lines.

[c9] 9.The color converter and enhancer of claim 8 wherein the preliminary and enhanced luminance values are Y values and the chrominance values are U and V values, wherein color converter and enhancer outputs lines of YUV values having enhanced luminance values and chrominance values,
whereby RGB values are converted to YUV values.

[c10] 10.The color converter and enhancer of claim 2 wherein each of the incomplete pixels has only one color value, either a R value or a G value or a B value.

[c11] 11.The color converter and enhancer of claim 10 wherein the incomplete pixels form a Beyer pattern.

[c12] 12.The color converter and enhancer of claim 2 wherein the first multi-line buffer is a 7-line buffer for storing at least 7 lines of the incomplete pixels;
wherein the second multi-line buffer is a 5-line buffer for storing at least 5

lines of the preliminary luminance values;
wherein the third multi-line buffer is a 3-line buffer for storing at least 3 lines of the enhanced luminance values.

[c13] 13.The color converter and enhancer of claim 2 wherein the chrominance generator combines two blue values and a block of enhanced luminance values to generate each U chrominance value;
wherein the chrominance generator combines two red values and a block of enhanced luminance values to generate each V chrominance value.

[c14] 14.The color converter and enhancer of claim 13 wherein the block of enhanced luminance values comprises a 3 by 3 box of enhanced luminance values that are averaged before being combined with the red or blue values.

[c15] 15.A method for directly generating enhanced YUV pixels from red (R), green (G), blue (B) pixels in an un-interpolated pattern comprising:
receiving an input block of at least 3 rows of at least 3 pixels per row of R, G, and B pixels in the un-interpolated pattern wherein each pixel location in the un-interpolated pattern is a partial pixel that is missing at least one of the R, G, and B color components;
determining a pattern type for the input block and selecting a selected coefficient block in response to the pattern type;
multiplying the input block by the selected coefficient block and summing to generate a preliminary Y component that represents an average brightness at a center of the input block;
generating and storing preliminary Y components for each pixel location;
multiplying an enhancement block of the preliminary Y components by an enhancer coefficient block and summing to generate an enhanced Y component that represents an edge-enhanced brightness at a center of the enhancement block;
generating and storing enhanced Y components for each pixel location;
reading stored enhanced Y components for locations in the input block and generating an average Y value for the input block from Y enhanced components;
reading at least two B pixels from the input block;

generating a U component from the at least two B pixels and from the average Y value while ignoring R and G pixels from the input block;
reading at least two R pixels from the input block; and
generating a V component from the at least two R pixels and from the average Y value while ignoring B and G pixels from the input block;
wherein the U and V components represent color of a YUV pixel while the enhanced Y component represents brightness of the YUV pixel,
whereby R, G, B pixels in the un-interpolated pattern are enhanced and directly converted to Y, U, and V components of YUV pixels without RGB interpolation.

[c16] 16.The method of claim 15 wherein generating the U component and generating the V component occur when a center pixel in the input block is a G pixel, but do not occur when the center pixel is a R or a G pixel.

[c17] 17.The method of claim 15 wherein the un-interpolated pattern is a Bayer pattern wherein each pixel location is a mono-color pixel that is missing two of the R, G, and B color components.

[c18] 18.A color-space converter comprising:
input buffer means, receiving red (R), green (G), and blue (B) mono-color pixels arrayed in a pattern representing an image, for storing an input block of at least 3 lines of at least 3 mono-color pixels per line;
luminance calculator means, examining a pattern of the R, G, B pixels in the input block to determine a coefficient block, for multiplying the R, G, and B pixels in the input block by the coefficient block to generate a preliminary luminance component for a center pixel location within the input block;
preliminary luminance storage means, receiving preliminary luminance components from the luminance calculator means, for storing preliminary luminance components for pixel locations in a YUV color space representing the image;
enhance means, receiving a block of the preliminary luminance components from the preliminary luminance storage means, for multiplying the preliminary luminance components in the block by a filter coefficient block to generate an enhanced luminance component for a center pixel location within the block;

luminance storage means, receiving enhanced luminance components from the enhance means, for storing enhanced luminance components for pixel locations in a YUV color space representing the image; and

chrominance calculator means, receiving a least two B pixels from the input block and receiving at least two R pixels from the input block, for generating a U chrominance component for the center pixel location within the input block by averaging the at least two B pixels and averaging at least 9 enhanced luminance components from the luminance storage means for pixel locations within the input block, and for generating a V chrominance component for the center pixel location within the input block by averaging the at least two R pixels and averaging at least 9 enhanced luminance components from the luminance storage means for pixel locations within the input block,

whereby Y, U, and V components are enhanced and generated directly from the R, G, and B mono-color pixels in the input block without generation of multi-color RGB pixels.

[c19] 19.The color-space converter of claim 18 wherein the enhance means, the luminance calculator means and the chrominance calculator means are programmable means in a digital-signal processor (DSP) or in an associative array processor.

[c20] 20.The color-space converter of claim 18 wherein the input block is exactly 3 by 3 pixels and the center pixel location is a middle location.